

I have a Synergy II+ with midi,  
Kaypro II computer, Gemini printer, additive  
Synthesis editing library, voice library 2.0, and 3 cartridges

T.D. PIGGOTT

PRELIMINARY OPERATION OF THE  
SYNERGY II PLUS w/ COMPUTER

for 1500<sup>00</sup>.

The SYNERGY II PLUS is actually now a GENERAL DEVELOPMENT SYSTEM. This system, referred to as the GDS, is the mother system from which the SYNERGY'S design in hardware and software was accomplished. The culmination of the GDS research and development has resulted in a new "GDS" in the form of the SYNERGY II PLUS, which surpasses the mother system by a great deal. Throughout this guide, the SYNERGY II PLUS will be referred to as the GDS.

It must be assumed that the system you have consists of:

- A SYNERGY
- The 3X software chips
- MIDI
- The RS232 connector
- Seq and Rec out jacks
- A KAYPRO II or recommended equivalent

..... and proper installation by DIGITAL KEYBOARDS or an authorized service center.

PROPER CONNECTION: The RS232 Cable supplied with the system should be connected to the connector on the back of the keyboard and the RS232 connector on the back of the computer. Proper electrical connections and audio connections should be made in accordance with the proper labels near jacks and electrical connections. Turning on the power to both the keyboard and the computer, the KAYPRO will ask you to insert a disk marked "SYSTEM" into the A drive. Proper insertion, care and procedures for this are available in your KAYPRO manuals.

At this time, you can insert VOICE DISK I into the B drive of your computer. Now you are ready to examine the basic operation and understanding of the displays and how the switches on the keyboard panel interact with them.

On the computer terminal, TYPE SYNHCS RETURN. This is the program you will use the most in the operation of your GDS. It gives you the basic menu from which the GDS programs can be accessed. Here is what you will see, and what each of the programs mean:

This equipment is in Excell. Cond. and was ~7000<sup>00</sup> 5 years ago.  
Great Midi Controller!!

- ```
=====
```
- 1) Create or Edit Cartridge Load File (.local)
  - 2) Create Voice Documentation File
  - 3) Select Current Disk Drive
  - 4) Program Voice Cartridge (DK-1/CP)
  - 5) Load Synergy Machine State (DK-1)
  - 6) Save Synergy Machine State (DK-1)
  - 7) Load, Save, or Edit VRAM Image (DK-1)
  - 8) Disable VRAM Operation (DK-1)
  - 9) Synergy Extended Programmer (DK-1)
  - 10) View DOC File
  - 11) List Synergy Related Files
  - 12)
  - 13) Test Synergy Communications (DK-1)
  - 14)
  - 15) Create or Edit Voice File (DK-1)
- ```
=====
```

Enter function number ->

- 1) Allows you to compose a cartridge from the voices on a disk, in any order you wish, making your own arrangement of voices for a cartridge. This can be done without the keyboard attached, but not allow for individual voice edits.
- 2) Allows you to document your voices, or leave yourself notes about the effective playing range, how many keys playable, how many filters, and general notes of application of the voice. This is useful when exchanging voices with other people, so there is a better understanding of how the voice was to be used.
- 3) Since most voices will be on the B drive, this allows you to access it and save your new creations of voices, sequences, and cartridge images. Of course, you can save on the A drive as well by using this program to select the desired drive.
- 4) This program will be used with a cartridge burner. This is the software that will allow you to burn your own cartridge of voices into E-PROMS and blank housings, supplied by DIGITAL KEYBOARDS.
- 5) This program is used to allow you to save your voices, edits, program modes, and sequencer contents under one " FILE " name.
- 6) This program is used to allow you to recall your voices, edits, program modes, and sequencer contents under one "FILE" name.

- 7) This program lets you make up cartridge images of various voices, in any order you wish ( as if you were actually making your own cartridge arrangement ) and allows you to edit each voice as you go along, so the final cartridge image consists of the voices and their edits as well. The keyboard panel is used to make these edits. This program also allows you to save the contents of your work under a single " FILE " name.
- 8) Lets you disable the VRAM image, returning the keyboard to the original internal voices and its non-computer editing programs. Its state can still be saved under program 6 with the computer.
- 9) This program is intended for studio or live performance. It allows you to have a series of steady states " on call " from the keyboard. This means you can have several " SYNERGIES " ready to call up from the computer, consisting of new voices, sequences , programs, and edits, without using the computer to call up the file names. A user can have access to 12 X 24 voices, 12 X 4 programs, and 12 X 4 tracks of sequential data on call during a performance. This can be extended indefinitely.
- 10) Allows you to recall your notes about a voice and read them.
- 11) Lets you view all your " FILES " of voices, cartridge images, sequences etc.
- 12) FUTURE USE
- 13) One of the many tests which let you be sure that proper connection and communication exists between the parts of this system.
- 14) FUTURE USE
- 15) This program is the one which makes the SYNERGY programmable by today's standards. This allows you to create your own voices using the appropriate software. It also allows you to look at the numerical data of already made voices, alter that information, and turn voices into others by making your own adjustments or changes. These new voices or synthesized creations can then be stored under your own file names.

\* #1, #11 or other, do not press the symbol (# ), rather, only the number itself. # is used in this script for clarity only.

4.

## BASIC OPERATION OF SYNHCS PROGRAM 1

### CREATING A CARTRIDGE LOAD FILE

- a. Since the voice files will come from the disk in the " B " drive, we need to address that drive. Select \* #3 ( RETURN ) on the terminal. The computer will ask for a drive letter. TYPE B. The computer will now address that drive.
- b. Press #11 RETURN on the terminal. This will list your voice files ( and others if any ) so you can see what voices you may select from for cartridge imaging. IF you have a printer connected, print them out. Otherwise, just make a hand written list of a few voices so you can continue operation procedures.
- c. Press RETURN to go back to main menu. Now press #1 and RETURN. The display is ready for your next command. You could enter a file name to load the entire display or move on to load individual voices yourself. PRESS RETURN. You are now ready to load single voices. The bottom of the display asks you to choose a slot number. Choose one from 1-24. ( followed by RETURN ) Now the display asks you for a voice file name. Type one in from your list, followed by return. The voice will be loaded from disk B to the voice slot #4 on the display, and therefore to voice slot 4 on the Synergy. In this way you can load as many voices as you wish ( you don't have to fill all slots to keep a cartridge file.
- d. To save the cartridge arrangement under one name, press RETURN again. It will ask you to name your grouping. After you've typed a name, press RETURN and the file will be saved on drive B.

PRESS RETURN TO RETURN TO MAIN MENU.

( the following page is a print of the display you have been working with.)



## Cartridge Image Load File Generator / Editor

SYN V3.12

Free Space: 7729

Slot	Voice Name	Osc.	Filt.	Size	Slot	Voice Name	Osc.	Filt.	Size
1	G7S	4	2	303	13		0	0	0
2		0	0	0	14		0	0	0
3		0	0	0	15		0	0	0
4		0	0	0	16		0	0	0
5		0	0	0	17		0	0	0
6		0	0	0	18		0	0	0
7		0	0	0	19		0	0	0
8		0	0	0	20		0	0	0
9		0	0	0	21		0	0	0
10		0	0	0	22		0	0	0
11		0	0	0	23		0	0	0
12		0	0	0	24		0	0	0

Enter slot number or return to save file -&gt;



## Program Voice Cartridge

-----

Check the following:

- 1) Cartridge programmer is connected to the host RS-232 port.
- 2) Programmer VPP switch is in the off position.
- 3) No cartridge is inserted in the programmer receptical.

Enter cartridge file (.CRT) name.-->

This program allows the burying of E PROMS into the cartridge blanks, for the making of one's own cartridge from the cartridge images made on the system. At the time of this reference manual, the cartridge burying hardware has not yet been finalized. When this takes place, the information will be available for adding the burning of cartridges to this system.

There is no " magic " in the burning of digital information representing voices into the E PROM format. A technically equipped person could do this with a standard E PROM burner, if the correct chips and blank housings were available.

The user is encouraged, however, to use the entire system with computer, even on stage. The performance features, including sequencer recall, are never going to be matched by cartridge burning. In fact, the cost of a hard burned cartridge is much higher than the cartridge image as stored on disk.

### LOADING THE SYNERGY MACHINE STATE

- a. Return to the main menu.
- b. Press 11 and return to view the file names again.  
Copy down one of the file names ending with .SYN
- c. Return to main menu. Press program #5 and return.  
Type in the file name as asked, ending with .SYN.  
You do not need to type anything but the file name and  
RETURN ( not the .SYN itself.)
- d. The keyboard will now be loaded with a set of voices,  
their edits, a set of programs, and a sequence which  
can be heard by depressing the ON switch in the  
sequencer.

You have just loaded the entire SYNERGY machine state from a single word file name. This recall of machine state is an important feature for recall of musical information in a recording studio or on a live performance stage.

### SAVING THE SYNERGY MACHINE STATE

- a. Erase the sequencer tracks in the usual manner.
- b. Make some adjustments to the voices, program modes, and record your own brief sequence of a few tracks.
- c. TO SAVE: PRESS program #6 on the terminal, followed by return. The display will ask you to name it ( anything you want up to 8 characters.) Press return and the entire SYNERGY contents will be saved under the file name given. This can be recalled at any time, using program number 5.

### CARTRIDGE IMAGE LOAD FILE GENERATOR / EDITOR

Having returned to the main menu, press # 7 RETURN. The display will look like the first program display. It operates exactly the same way, ( see pages 4 & 5 ) but with one important difference. The program # 1 lets you " shuffle" the voices around without a keyboard attached. This is something you might do on the road away from the keyboard, but with your portable computer.

Program 7 , however, lets you load a voice and edit it too, with respect to transpositions, Center/Sensitivity defaults, vibratos, portamentos etc. All saving and recalling procedures are the same.

### DISABLE VRAM OPERATION ( DK-1)

Return to the main menu. Program #8 is called up with 8 on the terminal, folloed by RETURN. When you do this, you are asked the question:

DISABLE? ( Y/N )

If you type the letter " Y " the VRAM is disabled, the CART switch stops flashing, and the SYNERGY returns to its normal state and internal voices.

NOTE: When you are in VRAM operation, you are working off the voice files on disk, not on the internal voices of the SYNERGY.

### VIEW DOC FILE

Having gone back to the main menu, type # 10 and RETURN. The display will ask you for a file name for which you have written some notes. Type in the one you did before, and the first display of that documentation will appear, with your range ( FULL ) showing. Press the RETURN again and you'll be able to read the notes you made. Press RETURN once more to go back to the main menu.

### LIST SYNERGY RELATED FILES

Simply press # 11 on the terminal, and the list of files will appear as before. If you wish to see the list of files on the A drive, use the main menu program 3 to switch to the A drive, then press 11 again. Be sure to make B your current drive when finished, as we will continue from that point.

### FUTURE USE

Currently, #12 is not being used for any programs. There are plans to add more programs for this slot. These will be added to your system with a new disk when available. This also applies to program #14.

### TEST SYNERGY COMMUNICATIONS ( DK-1 )

This program is used to assure that communication to and from the SYNERGY is correct and operational. Type #13 and follow instructions , which are clear and accurate.

#### Synergy / Host Data Path Test

Be sure the data cable is connected between the Synergy and the computer. Press "RESTORE" followed by "PROGRAM 4" on the Synergy. The upper row of voice will display the Synergy communications status and the lower row will display the last byte sent to the Synergy.

Type any character to start test.  
Type "ESC" at any time to return to the Main Menu.

Passes completed= 0



## Performance Program Controller / Editor

	Set	Prog	Cartridge	State File
1	On	1	TEST	
2	On	2		
3	On	3		
4	On	4		
5	Slow	1		
6	Slow	2		
7	Slow	3		
8	Slow	4		
9	Fast	1		
10	Fast	2		
11	Fast	3		
12	Fast	4	12CRT	12SYN

Alternate control file = QPRG

Command? (1 - 12,L,S,A) ->

Having gone back to the main menu, Press program #9 RETURN. The display before you is the most important of the performance displays, since it allows you to have access to many voices and sequences on stage, all addressed by the SYNERGY control panel.

To load this, you need a series of CRT ( cartridge images ) files, and SYN ( machine states and sequences ) files on your disk. You use positions 1-12 to load these file names for instant recall by the Synergy. The above display can hold 12 complete SYNERGIES, full of voices, edits, program modes and sequences. Examples of calling these up are listed in the exercise section at the end of this reference manual.

ALTERNATE CONTROL FILES will allow you to set up chains of files, one to the next, making it possible to extend the number of performance set-ups from 12 to a larger number.

Below, next to COMMAND? you have:

1-12: Choose a number and put the files of your choive into the chosen slots.

L : Load a set of Synergy states

S : Save a set of Synergy states

A : Lets you name and call up alternate files of the same size.

NOTE: TO EXIT THIS PROGRAM, USE CTRL C ( CONTROL C ) and it will take you to the main menu.

### CREATE OR EDIT VOICE FILE ( DK-1 )

Program #15 allows you to create your own voices. There are many phases to learning about this part of the GDS concepts, all of which are extensive. They are:

1. LEARNING TO BRING UP EACH DISPLAY.
2. LEARNING WHICH CONTROLS ON THE FRONT PANEL PERFORM WHAT TASKS FOR A PARTICULAR DISPLAY. SOME MUSICAL DEFINITIONS.
3. CALLING UP EXISTING VOICES FOR STUDY AND ALTERATION.
4. THE THEORIES OF SYNTHESIS USING THIS SYSTEM: HOW TO MAKE YOUR OWN SOUNDS.

While there are many details related to the voicing operation, they are logical, consistent, and precise. The very advantage of this voicing software is the accuracy of the numerical data that will produce and control a sound. Many of the voicing theories ( how sounds are analyzed or re-created ) have been known for years. There has never been, however, a collection of hardware and software to let you piece all the information together such as that of the GDS/SYNERGY project.

Take your time in the execution of each of these sections, and you will eventually become as fluent with its operation as with any other keyboard or synthesizer process.

To begin:

PRESS # 15 and RETURN....wait a few seconds for the system to load into the SYNERGY, changing it from a live performance instrument to a complete synthesis laboratory.

Voice: . . .

Current drive: B

```
=====
```

- 0 = Clear all filters
- 1 = Load a voice file
- 2 = Save voice file
- 3 = Set number of oscillators
- 4 = Set default patch
- 5 = Read Filter Only
- 6 = Exit to Main Menu
- 7 = Select current drive
- 8 = List .VCE files
- 9 = Dump VCE displays to LST:
- 10 = Clear Voicing System

```
=====
```

Enter command character or return for exit ->

On this first display, the numbers above will perform the following functions:

- 0 = clearing all the filters back to " 0." If you have a voice with filters, and wish to retain all but the filter values, or wish to make new filter data, use this command after you have loaded a given voice.
- 1 = Load a voice file lets you look at the numerical data in a particular voice. You can do this at any time. It is especially useful to learn how particular sounds are made.
- 2 = Save a voice file allows you to store your synthesis under a file name for recall later on.
- 3 = Set the number of oscillators is used to determine how many oscillators you want activated each time a key is depressed. Choosing 4 oscillators per key would allow you to have 8 key polyphonicity on the keyboard for that voice. There are 32 oscillators all together, and you can have from 1-16 per key for any voice.
- 4 = Set default patch is used to assign each of the oscillators or groups of them to a job function. In patch #1 all oscillators are listened to, and are configured to do additive synthesis, the heart of the GDS system's voicing techniques. Other patches are used to combine the

oscillators in various combinations of additive and modulated formats.

- 5 = Read filter only lets you bring a popular filter setting or file into another voice patch. In this way you can "shuffle" filters around to accomodate various voices, and therefore, save a lot of time.
- 6 = Exit to main menu takes you from the voicing system back to the main menu of activities.
- 7 = Select Current Drive lets you access either A or B drives.
- 8 = Lets you see what voice files you have on the disk.
- 9 = Dump lets you print out your list of voice files on a printer.
- 10 = Clear Voicing System is a default of having no voice parameters present. It is a null file for quick clearing of previous data, letting you start from scratch to make new voices.

#### BRINGING UP THE DISPLAYS TO BE USED IN VOICING

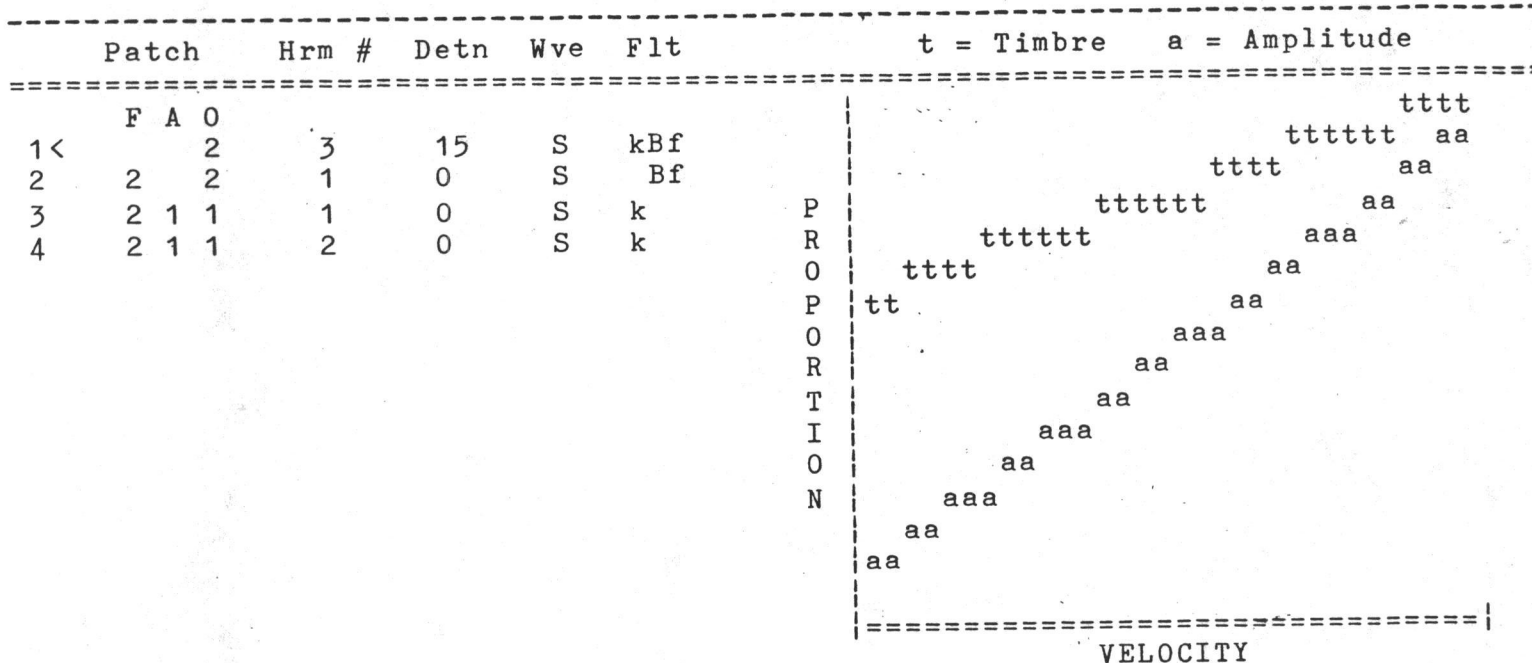
PRESS RETURN to see the VOICE display.  
 PRESS PROGRAM 1 on the SYNERGY front panel to bring up the oscillator display.  
 PRESS PROGRAM 2 on the SYNERGY front panel to bring up the FILTER display.  
 PRESS PROGRAM 3 on the SYNERGY front panel to bring up the KEYBOARD EQUALIZATION display.  
 PRESS PROGRAM 4 on the SYNERGY front panel to bring up the KEY PROPORTION display.  
 PRESS SAVE on the SYNERGY front panel to return to the VOICE display.  
 PRESS RETURN on the computer to return to the VOICE MENU listing.

Before we get into what each does and how to access the parts, spend a few minutes toggling between the displays until you can go to each smoothly.

---

From the VOICE MENU display, select #3, Set the number of oscillators. (naturally folloed by return.) The display says to enter the number of oscillators. Press 4 RETURN and the first display ( VOICE ) will appear. Now we are going to see how to move the cursor around and alter each parameter.

Transpose: 0  
TUNE pot= Harmonic



RESTORE switch will display COPY FROM ( whichever oscillator number is being pointed at. To copy the data from that oscillator to another, simply follow the pressing of RESTORE with the oscillator ( voice number switch ) you wish to copy to. Pressing the RESTORE switch before another oscillator number is pressed will turn off the copy command with no changes.

TUNING knob controls the harmonics of the oscillator being pointed to, provided the upper right corner of the display has the word Harmonic in it.

CARTRIDGE switch changes the word Harmonic to DETUNING. Now the TUNING control will alter the values of the detuning of the oscillator being pointed to.

CARTRIDGE switch pressed a third time will change the word from DETUNING to APERIODIC, again adjusted by the tuning control. This allows for aperiodic fluctuations in vibrato rate to occur. Press CARTRIDGE again and the display will return to the TUNING control's adjustment of HARMONICS again.

SWITCH 22 allows you to assign the oscillator being pointed to to either a SINE wave or a TRIANGLE wave.

SWITCH 23 allows you to assign KEY PROPORTION ( k ) to that particular oscillator. This will be explained later. This switch toggles on/off, ( k ) or ( ).

SWITCH 24 allows you to assign an oscillator to an A filter ( Af ) or a B filter ( Bf ), again according to the oscillator being pointed to in left part of display. It toggles to Af, Bf, and no filter assigned.

SWITCHES 17, 18, & 19, let you determine the Frequency, Adder or OUTPUT registers of each oscillator, depending on which " PATCH " you have selected. In an additive patch ( patch 1 ) only 18 and 19 will be active. This will be explained in further documentation.

TIMBRE/AMPLITUDE values and display are controlled by the CENTER and SENSITIVITY controls as usual, but interacting with the display. These curves give a visual indication of the velocity control of interpolated values.

TRANSPOSE is activated as in performance software, simply lighting the Transpose switch and choosing a key below that switch for various transposition values.

PORTAMENTO, VIBRATO ( depth, rate, delay ) are as usual.



Ensemble

Transpose: 0

Oscillator: 3

		Frequency				Amplitude							
		Value(%)		Time(ms)		Total Time		Value(db)		Time(ms)		Total Time	
		Low	Up	Low	Up	Low	Up	Low	Up	Low	Up	Low	Up
1		0	2	0	0	0	0	72	64	26	28	26	28
2								69	57	326	91	352	119
3								54	49	2929	326	3281	445
4								S-> 1	0	6576	652	9857	1097
5								0	0	64	57	9921	1154
6													
7													
8													
9													
10													
11													
12													
13													
14													
15													
16													

Acceleration: Low= 30 Up= 30

PRESS PROGRAM 1 on the SYNERGY front panel to bring up this display. This is called the OSCILLATOR display. The switches and knobs relating to this display are the same for each oscillator number, which is chosen by the VOICE switches as described before.

VOICE SWITCHES 1-16 let you address a particular point number for alteration of a value.

SWITCH 17 lets you select the number of points desired for an envelope. Use the VOICE SWITCHES to assign that number.

SWITCH 18 lets you set a SUSTAINPOINT ( S ) to the point selected.

SWITCH 19 lets you assign a LOOP, ( L or R ) point to the point selected.

SWITCH 20 lets you toggle between L and R type loops. ( All loop points occur before a SUSTAIN point, therefore, there must be enough points in the envelope for the type 3 and 4 envelopes to occur at all.

SWITCH 21 allows you to scale values downward, using TUNING knob. All values scale together.

SWITCH 22 allows you to scale values upward using the TUNING knob.

SWITCH 23 lets you toggle from control of the FREQUENCY envelope to the AMPLITUDE envelope.

SWITCH 24 lets you go from UPPER to LOWER bounds values.

CART SWITCH lets you toggle between VALUE and TIME.

RESTORE is used to copy bounds, lower to upper or upper to lower.

SET/TUNING KNOB allows you to set the acceleration rates up or down.

SET/VOICE SWITCH allows you to change between OSCILLATORS.

NOTES: The preceding list of switch addressments is used to help you go from one parameter to the next. Another way to look at it is as follows:

The value to be altered by the TUNING knob will always be FLASHING. To move the FLASHING ( and therefore, controllable ) parameter, use the above guide, which lets you address the various parameter areas.

For practice, move the controllable parameters around using the above combination of switches and the TUNING control, not paying attention to the values themselves, but to the operation of getting from one place to the next.

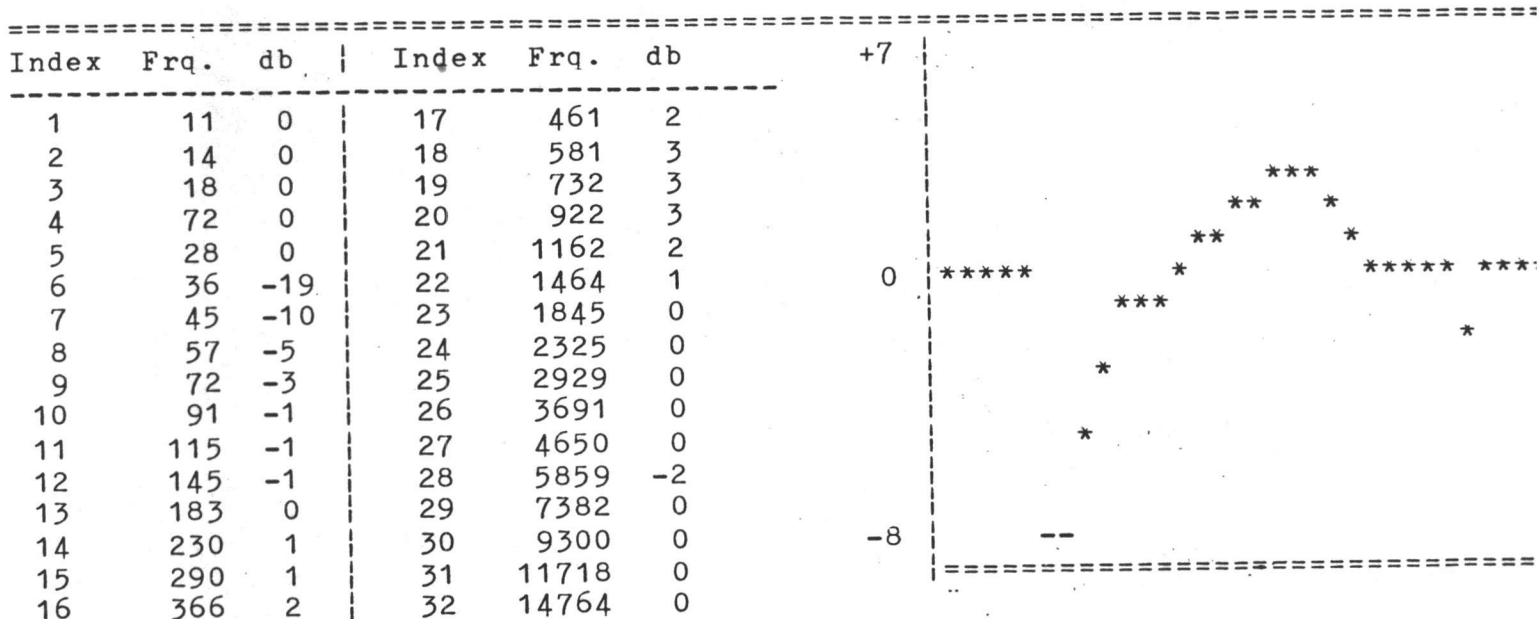
The logic of the voicing theory will be described later in this manual.

Ensemble

Voice: G7S

Transpose: 0

Filter# Bf 1



PRESS PROGRAM SWITCH # 2 on the SYNERGY to achieve the FILTER DISPLAY.

The filter values are changed by:

1. DEPRESSING A KEY ON THE KEYBOARD, which moves the display pointer and flashes in the correct db/freq range on the left numerical display.
2. Moving the TUNING knob to alter the value, plus or minus as indicated on the graph and the equivalent numerical value.

SWITCH 17: Brings up Af ( A FILTER ) whenever needed.

SWITCH 18: MOVES VALUES DOWN, SHIFTING ONE STEP AT A TIME.

SWITCH 19: MOVES VALUES UP, SHIFTING ONE STEP AT A TIME.

SWITCH 20: Lets you scale all values DOWN by 1 to 16 using VOICE SWITCHES.

SWITCH 21: Lets you scale all values UP by 1 to 16 using VOICE SWITCHES.

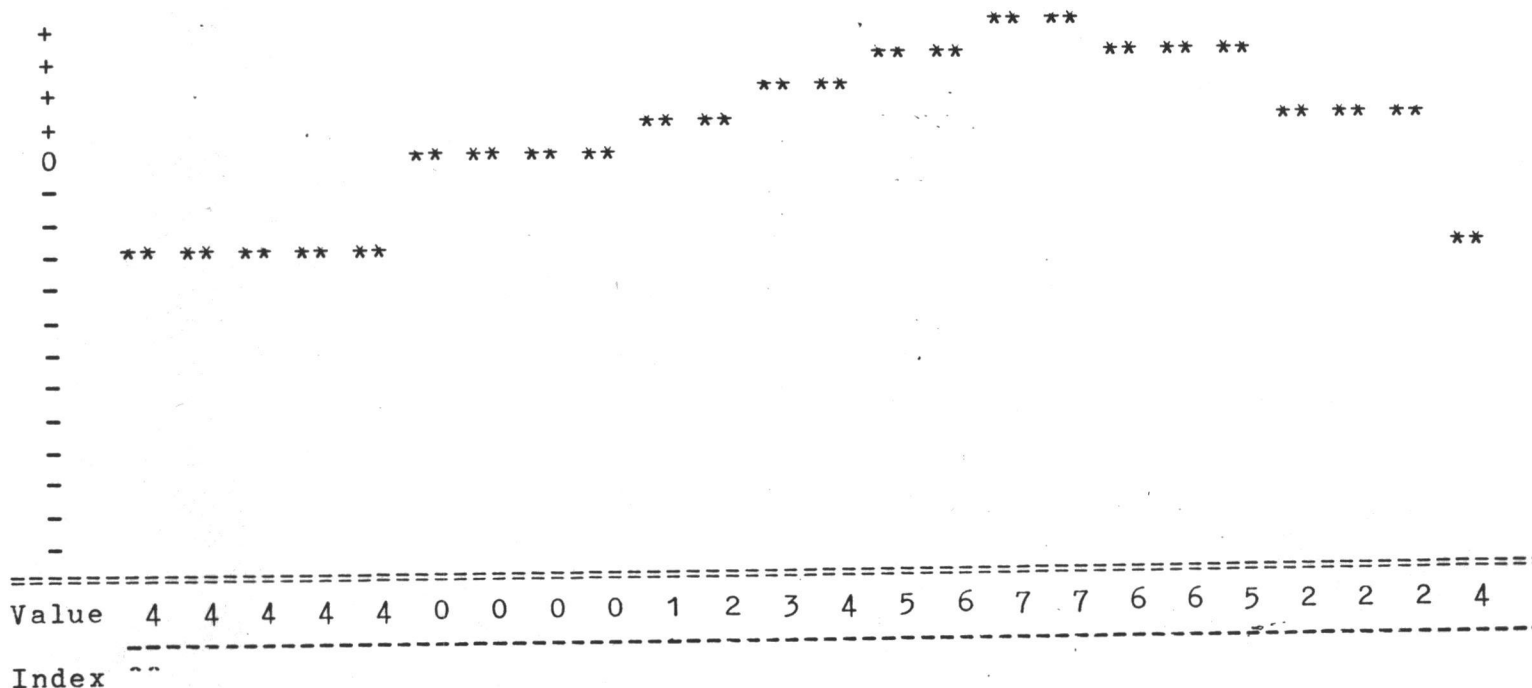
SWITCH 22: Lets you copy from a FILTER # ( Using Voice Switches ) to the CURRENT FILTER.

CART SWITCH lets you scale the graph from + or - 8,16,32,or 64.

Ensemble

## KEYBOARD EQUALIZATION

Transpose: 0



PRESS PROGRAM # 3 to attain the KEYBOARD EQUALIZATION DISPLAY.

KEYS will move the pointer of the graph.

TUNING KNOB will let you move the amplitude of the keys, 4 keys at a time, and globally for each voice ( all oscillators together. This is used to raise or lower amplitude ( volume levels ) on a global basis to desired EVEN or UNEVEN levels. It is used also to check extreme ranges by TRANSPOSING the keyboard up and down an octave or so, and adjusting the levels accordingly.

Ensemble

Key Proportion

Transpose: 0

Upper

B  
O  
U  
N  
D  
S

Lower

Value	0	0	0	0	0	4	5	6	7	8	8	9	10	11	13	15	19	24	27	32	32	32	32	32
-------	---	---	---	---	---	---	---	---	---	---	---	---	----	----	----	----	----	----	----	----	----	----	----	----

Index

PRESS PROGRAM # 4 of the SYNERGY front panel to attain the KEY PROPORTION display. This is used to reduce or add time values according to key number, but only to those oscillators to which a (k) is added in the VOICE DISPLAY. One example of its usage is in the making of piano sounds, whose decay rates at the upper end of the keyboard are faster than those of the lower keyboard.

KEYS are used to move the pointer.  
TUNING KNOB is used to adjust values up or down.

PRESSING THE SAVE SWITCH returns the display back to the VOICE display. The RETURN key of the terminal will return you back to the voicing program menu.

It is suggested that the manipulation of the parameters in each display be studied and practiced without regard to trying to make voices.

### NEXT STEP: ALTERATIONS

Press #1 of the VOICE menu and load a voice file name from your list. Not only can you study how a voice is constructed, but you can begin to alter values on each display to see and hear their effects. Take one display at a time and do as many alterations as you can as found on the pages with references to that the display and the switches and controls that alter each parameter. Many alterations will not apply to a voice. Often the alterations will be very subtle, and have to be listened to carefully.

### GENERAL THEORY OF VOICING ON THE SYNERGY II PLUS/GDS SYSTEM

Here are a series of comments, descriptions and hints for comprehension of the GDS voicing system. These can be reviewed as often as necessary, to strengthen your understanding of how the parameters you control on the displays all interact to produce good sounds. Various books, that have been published on acoustics, physics, sound synthesis and the like, can all be used as reference towards building a solid understanding of the components of sound. These will all contribute to your ability to attain sounds you have wanted to synthesize for yourself.

- \* There are 32 oscillators in this system. They consist of either SINE or modified TRIANGLE waveforms. If you use 2 oscillators per key to make a voice, you will have 16 playable keys. If you use 4 oscillators per voice, you will have 8 keys playable. If you use 3 oscillators per voice, you will have 10 keys playable with 2 left over.
- \* The more complex the voice is, the more oscillators will be required.
- \* Each oscillator can be used in three ways: to be heard, to be summed with another one, or as a modulator to another. This is shown in the patch display, which indicates how the oscillator is being used in a particular voice patch.
- \* The following display is activated by #4 of the VOICE MENU display. It contains various ways in which patching of oscillators is accomplished:



Voice: G7S.

Current drive: B

=====

Standard Oscillator Patches:

```

#1  1 + 2 + 3 + 4 + 5 + 6 + 7 + 8
#2  (1~2) + (3~4) + (5~6) + (7~8)
#3  ((1+2+3)~4) + ((5+6+7)~8)
#4  (1~2+3)~4 + ((5~6+7)~8)
#5  (1~2) + 3 + 4 + (5~6) + 7 + 8
#6  ((1~2)~3) + ((1~2)~4) + ((5~6)~7) + ((5~6)~8)
#7  (1~2) + (1~3) + (1~4) + (1~5) + (1~6) + (1~7) + (1~8)
#8  (1~2~3) + (1~2~4) + (1~2~5) + (1~2~6) + (1~2~7) + (1~2~8)
#9  (1~2~3~4) + (1~2~3~5) + (1~2~3~6) + (1~2~3~7) + (1~2~3~8)
#10 ((1~2+3)~4) + ((1~2+3)~5) + ((1~2+3)~6) + ((1~2+3)~7) + ((1~2+3)~8)
#11 User Specified
#12 User Specified
#13 User Specified
#14 User Specified
#15 User Specified
#16 User Specified

```

Enter patch number ->

PATCH #1 represents additive synthesis. Each oscillator has values which are "heard" as they occur. It is the most accurate form of synthesis, but requires a larger number of oscillators to attain results.

PATCH #2 is used in sets of 2 oscillators at a time. Number 1 uses its parameters to "modulate" number 2 which is listened to. Number 3 modulates 4 which is listened to etc. This modulation sets up a predictable array of sonic qualities, which helps to provide rich sonorities, aiding in the conservation of oscillators. This modulation is actually called PHASE MODULATION and CANCELLATION, not to be confused with Frequency Modulation as used in some synthesis techniques.

PATCHES #3-10 are various combinations of one oscillator modulating another, and in many cases mixing the modulation results with some additive synthesis techniques. This makes the synthesis process very unique and full of possibilities.

We will experiment with alterations of patches in various sounds at a later point, to show the results of altering the patches themselves.

The conclusion and concept is that the GDS has the accuracy of additive synthesis, and the conservation of combinational forms of synthesis as needed for certain sounds.

- \* HARMONIC values can be assigned to any oscillator, no matter how it is used. In addition to the standard harmonic series from 1 ( the fundamental ) through the 30th harmonic, "s" harmonics are possible, 1s,2s,3s, etc. These represent the semi-tones that would exist between the fundamental and 2nd harmonics. Access to them is especially useful in modulation applications and very useful in helping to produce " unmusical " qualities in sounds such as breath, bow scratch and lip buzz.
- \* Harmonics do not necessarily have to be in tune. In most acoustic instruments they are often not in tune, or are fluctuating under different playing activities. Therefore DETUNING of harmonics can be accomplished roughly 1/30hz. at a time. Additionally, 5 degrees of random detuning fluctuations are possible per oscillator. This is useful for many chorusing and imperfect treatments.
- \* The GDS is an expressive instrument because any musical parameter can be programmed to be controlled by the VELOCITY of the keyboard.
- \* Each oscillator is voiced twice. One set of numbers ( called the LOWER BOUNDS ) react: either when the CENTER/SENSITIVITY graph is at the full lower position on the display, or when the keys are played lightly ( with a light touch or slow velocity.) The second set of numbers ( called the UPPER BOUNDS ) react when either the CENTER/SENSITIVITY graph is at the full upper position on the display, or when the keys are played with a heavy touch ( or a faster velocity.) When the two sets of numbers between the LOWER and UPPER BOUNDS are significantly different, positioning of the CENTER control will allow averaging or INTERPOLATION between the two sets of values. The SENSITIVITY control allows the key velocity to alter the interpolation values and give " expression." Expressive nuance is actually the velocity control of the values of two sets of numbers.
- \* Each oscillator is voiced twice for amplitude values, specified in up to 16 points of envelope for the lower bounds and up to 16 points of envelope for the upper bounds.
- \* Each oscillator can be voiced twice for frequency values, specified in up to 16 points of envelope for the lower bounds and up to 16 points of envelope for the upper bounds.
- \* The VELOCITY controls interpolation characteristics of the envelope data separately from overall volume expression. TIMBRE center & sensitivity relate to the numerical data of the envelopes. Amplitude center & sensitivity control volume response only. Each are indicated by " t " and " a " respectively on the display ( VOICE DISPLAY.)

- \* The 16 point envelopes for each of amplitude and frequency, are independent per oscillator and per voice. However, one can " copy " one set of envelopes to other oscillators to speed up the voicing process considerably, then making slight alterations if desired.
- \* The extensive envelope routines make it possible to duplicate the amplitude and frequency paths of fundamentals and harmonics, as does occur in the documented analysis of acoustical sounds.
- \* The number of envelope points are used to aid in duplicating the multiple changes that take place in natural sounds. This makes the ADSR concepts of analog synthesizers outdated and impractical for certain applications, since some sounds have multiple envelope points in the attack stage alone, and different between one harmonic to the next.
- \* There are several " TYPES of ENVELOPES."

TYPE 1: A series of attacks and decays. Basically the sound begins with an attack, and decays while the key is still held down. If the key is released before the decay is completed, the envelope finishes at a given rate of speed. If it is desired to alter how fast or slow the envelope completes its path, when a key is released, it can be accomplished by the ACCELERATION RATE for both amplitude and frequency and for both bounds.

TYPE 2: An envelope which has a SUSTAIN ( S ) point after a series of attack points. Decay points begin after release of the key.

TYPE 3: An envelope with a LOOP ( L ) point. The envelope begins, goes to the SUSTAIN point and cycles back to the LOOP point, and continues between the SUSTAIN and LOOP points until the key is released. Oscillators with LOOP points signified with the L are independently looping.

TYPE 4: The same as TYPE 3, but the " L " is replaced with an " R " which stands for repeat. In this envelope all oscillators having the " R " wait for each other so as to be " together."

TYPE 1 is used for pianos, bass, harpsichords, plucked sounds, percussion sounds etc.

TYPE 2 is used for sustaining sounds, brass, some strings, woodwinds, sustained synthesizer sounds etc.

TYPE 3 is most useful for chorusing sounds, agitated sounds and active sound effects.

TYPE 4 is used for rolling percussion, arpeggiation, rotary speakers of organs and repeating mallet effects.

- \* Af FILTERS are filters ( one per voice, but it can effect several oscillators.) which are used to have the same values effect several oscillators. The Af is used mostly for modulators. In certain frequency ranges along the keyboard, the modulation may be excessive in one range and not enough in another. This filter is used to increase or decrease that effect by manipulating the degree of modulation according to key number.
- \* Bf FILTERS are filters that belong to one oscillator at a time. You can have several B filters per voice, up to the number of oscillators used in that voice. Again according to key number, these values let you add or subtract from the amplitude values of a particular oscillator in a particular range of the keyboard. This is especially important for instruments whose timbral characteristics change up and down the frequency range.
- \* Filters can be used to make exaggerations of amplitude or modulation up or down the frequency range, such as in the case where every few keys produce a different instrumental timbre or a different sound effect. This is how voice #24 of the internals, which has different percussion sounds in different ranges of the keyboard, is accomplished.
- \* Filters can be used to shut off certain ranges of the keyboard, such as extremes that are not needed, or at some voiced split point.
- \* Remember that the filters are SOFTWARE FILTERS , not digital filtering.
- \* Use the FILTER GRAPH to help in achieving smooth contours of filtering from one range to the next.
- \* KEYBOARD EQUALIZATION is the display used to raise or alter groups of 4 keys at a time with respect to volume. In additive synthesis the ear may hear certain qualities louder or softer than they should be for a particular instrument. The ability to raise or lower the volume levels according to frequency range will make a more realistic balancing of the sound. It works for modulated sounds in the same way, but effects only the additive ( listened to) oscillators. Alterations to the modulating oscillators would alter timbre, not desireable in this display.

- \* TRANPOSE should be used in the KEYBOARD EQUALIZATION display to assure that extreme ranges are in balance with respect to volume, especially should a user transpose a voice to a different range during a performance patch. ( This use of transposition is also suggested when setting FILTER values for the same reason.)
- \* KEY PROPORTIONALITY is used to alter the decay rates of a sound on a global basis or selected oscillators at a time. Those effected have a (k) assigned in the VOICE DISPLAY. It is used for PIANO ( to make the upper part of the keyboard decay more quickly than the lower ) and other instruments effected by a time/decay curve. It is especially useful to make synthesizer sounds, due to the unique nature of its activity. You could have a long decaying drone synthesizer sound at the low end of the keyboard, while the upper end was a sharp, plucked sound. Or you could have a plucked bass at the lower part of the keyboard, while the upper end has a slowly decaying lead synthesizer sound.
- \* A more subtle use of KEY PROPORTIONALITY is with respect to the decay times of modulators, dependent upon frequency range. This is especially useful in making brass sounds, where the lower lip buzz sound is to be less exaggerated than at the top end.
- \* A study of different voices will give the best starting points for learning how to voice the GDS system. Almost all parameters can be altered and listened to.
- \* During the voicing process, the sequencer can still be used to hear how a voice responds and sounds during playback.
- \* Each voice can be colored and stored with vibrato values, desired defaults etc.
- \* Voices can be tried with sustain pedal, portamento values and pitchbend treatments as a test of " playability."
- \* As a reference, it should be remembered that the Velocity can control the following parameters, assigned in the voicing process: Volume, timbre, attack time, decay time, pitch degree, pitch time, harmonic entry, speed of loops, modulation degree, speed of repeats, speed of musical tremelos, sustain lengths, a combination of these and more. As a guide to voicing, decide what you want the velocity to accomplish in a certain voice, then try to attain it.



## FURTHER THOUGHTS ABOUT THE SYNTHESIS PROCESS IN THE GDS/SYNERGY

Here are a few thoughts about the various synthesis techniques currently in use. They are stated to aid the user in understanding more about the synthesis process of the SYNERGY voicing system.

- \* There are many kinds of synthesis techniques. They are not separated by values of "good" and "bad," rather, they are different. They differ in sound quality, the process by which the sounds are made, and the hardware configuration. There are definite benefits to all of them, as there are specific limitations.
- \* Analog synthesis is the kind that most musicians are familiar with. It is a subtractive process, that is, you start with a rich waveform ( a family of basic tone color, full of harmonic content ) and remove those colors you don't want with filters. You control the filtering process, attacks and decays, pitch, and other musical components, with voltage. Therefore, the names like voltage controlled filters, voltage controlled oscillators etc. Analog synthesizers of this type are capable of "fat" sounds that are desirable for qualities like warmth, chorusing, ensemble, and expressive when used with devices that imitate human nuance ( like pitch bend, vibrato and volume changes.) Often, the analog synthesist tries to achieve "acoustic" qualities of a global nature, and although not acoustical at all, these qualities often supply the expressive energy provided by an ensemble of acoustical instrument players. This is especially true of "ensemble" energies, more than acoustical solo energies, except in the hands of an exceptional player. The players of analog instruments, who have a strong familiarity with proper phrasing of acoustical instruments, will often be able to create the "acoustical" feeling more than the instrument is capable of putting out in terms of raw, physical comparisons. Additionally, the analog synthesizer has a collection of sonic qualities, limitations and characteristics, which have established themselves as being unique, desirable and difficult to duplicate by any other means.
- \* Digital synthesis is currently a "buzz" in the music field ( APRIL, 1984.) Unfortunately, the largest exposure of this synthesis has been through commercial manufacturers of product, each pushing for a particular standard of acceptance. Some "digital" methods have been poorly represented, causing confusion amongst many interested people. It becomes difficult to separate the facts from opinion. Here, an honest attempt is made to clarify the differences between the theories, with little attempt to force judgements.

NOTE: It is important to realize that these comments are primarily from a musician who has learned about the technology. It can also be taken that these comments are partially opinion. However, they are expressed honestly, with a certain degree of authority, and with no attempt to deceive or mislead with information that is not correct.

### DIGITAL SYNTHESIS 1: SAMPLING

SAMPLING is actually not "synthesis" at all. Rather, it is a process by which a sound is recorded into a computer memory, and played back on command by a switch or a key. There are some keyboards which allow you to record a sound and play that sound back by hitting different keys on a keyboard. This is a "glamorous" dream for most musicians. The biggest advantage is "truism." Taking the time to understand the technology, one finds that, unless every note or two is recorded into memory and played back in its place, certain non-accurate qualities are heard as one moves away from the center pitch. (HENCE an A-440 note sung by a normal voice sounds like a slowed down recording when played two octaves lower, and like Donald Duck two octaves higher.) As memory is increased, more individual notes are recorded in various "keyboard" ranges, and the sound is more realistic as a copy. The sound becomes even more accurate if touch sensitivity allows for expressive nuance (which is usually volume.) Still, it takes a lot of dollars to allow the technology duplicate the tremendous number of nuances given by an acoustic instrument. The very physics of the bow on a violin do not match the up and down motion of a key. The sampling process is like having a series of pictures, each very accurate, but not subject to much alteration. Nevertheless, the advantages of such a system, especially in the hands of a skilled player, can outweigh and even fool the most trained listener. For the reproduction of sound effects, certain instruments, and certain percussion sounds, the method cannot be beat. It is not synthesis, however, it is recording and playback by a mechanical device.

### DIGITAL SYNTHESIS 2: HYBRIDS

Certain keyboards may have components which are digital, such as digital oscillators, or digital envelope generators or whatever. There is nothing wrong with these instruments at all. They often combine the advantages of both analog and digital fields to offer an instrument which appeals to certain users. The majority of the users, however, still relate to them as analog, since the process is usually still subtractive, and the filtering has timbre characteristics of "that" sound. They usually end up being more analog than digital. Remember, digital control is



not digital synthesis.

### DIGITAL SYNTHESIS 3: FM SYNTHESIS

FM means Frequency Modulation. The terms have been used for many years in analog synthesis, sometimes to refer to a "vibrato," and other times to refer to a type of "predictable distortion" which occurs when one oscillator of audio frequency range modulates another.

In the digital format, the audio waveform which you listen to is called a CARRIER. The oscillator which is used to modulate the carrier (like voltage control) is called the modulator. There can be more than one carrier or modulator. The "modulation" effect can be precise enough to give a tone color that is rich and musical. When the modulator is controlled by an envelope generator, you get a musical motion in time. This results in a type of sound quality known as FM synthesis. As a basis of comparison for those who are familiar with it: RING MODULATION produces the SUM and DIFFERENCE of two frequencies. They can be figured out mathematically. FM produces another set of "numbers" which represent pitches and tone colors of a different type. Complex combinations of carriers and modulators can produce many pleasant musical effects, some of which are quite different than analog qualities. Many acoustical representations are "closer" than the same attempts by analog. There are certain characteristics of FM which have to be dealt with by the user, however. If certain products of the modulations do not match up with the known mathematical logic of acoustical sounds, odd frequencies "pop" out called sidebands. They can occur anywhere along a keyboard's range, but usually are heard at the extreme ranges. Also, from the purist's view, the synthesist does not have control over (harmonics) every frequency or amplitude "path" in the output. Some tonal qualities, therefore, remain fixed, unlike acoustical vibrations. Despite the limitations, the FM process is strong because it allows a wide spectra to be produced with minimum oscillators, conserving the tone generation and increasing polyphonicity. Like analog, it can be recognized as having its own tonal benefits and limitations. One great strength that should be mentioned is the ability of this process to produce excellent bell, gong and metallic sounds. With enough software control, this method can produce very realistic orchestral sounds to all but the most experienced ear.

The skills in synthesizing sounds with FM can be developed to a very high degree, and will often "outperform" the analog attempt to produce acoustical representations, especially when enough hardware and software is used. It is interesting to note that lesser expensive synthesizers, which use the FM process, often add or treat the sound qualities with analog devices such as chorus devices, bucket brigades and detuning devices. These help to add the warmth and "chorus" effects that are desired by those who enjoy the benefits of analog.

#### DIGITAL SYNTHESIS 4: ADDITIVE

If not the oldest form of digital synthesis, this is certainly one of the earliest forms. This form of synthesis tries to duplicate the activity of each harmonic as it relates to the make-up of a sound. The analysis of sounds will show the changes of each harmonic with respect to volume and pitch change, from the time the sound begins until the time it ends. It is the most precise form of synthesis, since it allows the amplitude and frequency path of each component in a sound to move independently, as takes place in acoustical representations. As more about the make up of sounds is documented, one learns that the "harmonic series" is not a fixed set of mathematical pitches that contribute to the timbre of a sound, but a collection of independent, sometimes interpolating pitches that must be controlled separately to achieve the most interesting musical results. It is the process of breaking down a sound to its smallest known composition, and trying to duplicate it from scratch. The biggest limitation is that it takes a lot of tone generators (oscillators) to achieve the correct results. Its biggest advantage is precision and control. With enough oscillators, any sound should be able to be synthesized.

#### DIGITAL SYNTHESIS 5: PHASE MODULATION & CANCELLATION

This type of digital synthesis does not stand alone. It is related to ADDITIVE synthesis. It is used to conserve oscillators by providing a series of spectra produced by rotating the phase of digital oscillators, and mixing the results with more active additive oscillators. It depends greatly on precise control of a large number of envelope points. Unlike FM, it uses no adder or multiplier, and therefore is not useful on its own, except for the most basic of tones. It is most useful in the modulation of selected oscillators that are part of an additive array.

All the preceding synthesis methods are represented by current, available products. There are others, no doubt, with merit. They are not left out except by the frequency of exposure to the musician of this time period.

All the preceding forms of synthesis, both analog and digital, have one important characteristic. They all sound different. Each has a series of technical descriptions, substantiations, and applications. They all have advantages and limitations. It is the true synthesist, that becomes familiar with the qualities of each.

#### AFTER THE TONE GENERATION....WHAT?

Analog is FAT, CHORUSIE, WARM, even DIRTY. DIGITAL is super clean, articulate and uncommon to the average listener. However, DIGITAL has more precision than analog, due to the following important fact:

Analog is mostly dependent on hardware. Digital is dependent on hardware, but has a great dependence on software, which can be changed more easily than hardware. Computer software ( instructions ) can interact with digital hardware to afford the user more open ended possibilities and flexibilities than analog. It is like the difference between a mechanical calculator and a digital one.

#### THE SYNERGY/GDS SYSTEM AND ITS TRUE POWER AND ADVANTAGES

The software of the SYNERGY is truly remarkable. It took years and a lot of brain power to put together. It changes on a daily basis. The preceding information was offered honestly and from a non-commercial point of view. There are well known composers, scientists and software writers who would stand up for this system's strengths over any other. But the information given is to help you understand the vast potentials of the SYNERGY/GDS over other systems. Understanding the potentials will unlock your creativity to synthesize new and expressive sounds never heard before.

NOTE: Some users will want to attain the ultimate reproduction of acoustical instruments. Others will search for new and expressive sounds with the musical energy of the acoustical instruments. With this instrument, both will have the opportunity.

It is also important to realize that your understanding of the unique strengths of this system will allow you to produce better sounds more quickly. You do not have to be re-sold on the system. Still, comprehension of the technical capabilities will be unlocked by the realization of its unique features.

### PRECISE ENVELOPE CONTROL

There is no system that allows such independence of control as this one. One voice of 5 oscillators per key can have up to 5 sets of 16 different amplitude changes, 5 sets of 16 changes in frequency, and another two sets of the same to reflect musical expression. The precision of this envelope control will immediately separate the GDS/SYNERGY system from other systems. If you "come" from the analog instruments that use ADSR devices, there is an easy way to understand it all.

The A ( attack ) of a violin, for example, is not just one activity. The true violin attack has many subdivisions which make up the starting up process of a bow causing the string to move. The " scratch " itself is a series of mini attacks, but quite definable when broken down by sophisticated equipment. A decay does not have to be one motion either. It can have several decay " dips " on its way to a sustain point. Sustains are not steady....they often are full of motion like slight pitch deviations.

The complex envelope = the potentials of duplicating the imperfections that we translate into being the difference between accurate representations of acoustical sounds, and those that are electronic. Both are wonderful to hear.

As you work with this system, your ears will begin to hear and define many of the musical imperfections that give acoustic instruments their recognizable character. Your ears will sharpen greatly. As they become more capable, you can take comfort in knowing that you have the instrument to accurately let you " go after " what you hear.

If you are a PURE SYNTHESIST, you are probably tired of reading about the acoustical comparisons made so far. It is important to understand that the GDS/SYNERGY is capable of achieving much more than acoustical representations. The sonic offerings of this system far outnumber the acoustical instruments it might attempt to synthesize. However, in the case of most synthesists, the greatest learning about musical tones that are unique, interesting and expressive are generated after a solid foundational knowledge has been laid about the imperfect compositions of acoustical instruments of the past. In any case, it is an admirable pursuit of comprehension, if not the only one.

### MORE UNIQUE POSSIBILITIES

Taking the time to experiment with the software offerings in the voicing program. you will realize many more synthesizer possibilities. Looping envelope. Aperiodic vibratos. Keyboard performance modes like floating split. The wide parameters of programmable sensitivity on the keyboard. Intelligent portamento that seems to follow your hands. All these software functions can be changed, altered, expanded and discarded. That is the beauty of software control. As the system gets better, or offers more, you stand a better chance of upgrading than anyone who might be tied to a non-software controlled system.

### HOW DO YOU LEARN TO " VOICE " THE SYSTEM?

At the time of the writing of this manual, there is no formal method book on voicing this system. The techniques of voicing the system are actually a collection of experiences from people with backgrounds in music, analog synthesis, digital additive synthesis, FM, and no synthesis background at all. There are some helpful hints, however:

1. Get some basic sounds out of the system by following the examples on the learning disk.
2. Get a good feel of how the switches interact with the software displays.
3. Take existing sounds....study them....alter them into your own.
4. Change the things you want to. Don't like the ATTACK? Learn how to change it.
5. Seek technical books that make sense, like those that combine physics and music.
6. Call us....be patient. You have a lot more to work with than in an analog instrument. It will take you a little time if you're not of the technical world.
7. Try to define what you are trying to accomplish musically. Focus in on it. Refer to the operation of each parameter you wish to change.

In a short time, DIGITAL KEYBOARDS will publish a list of available reference books from which you can learn more information to help you voice. We are also working on a " procedures " manual for a step by step course in basic voicing techniques.



DON'T make the mistake of expecting the system to produce analog sounds! It can't. If you have a difficult time getting used to the clean sound of digital, here are some helpful hints:

1. Take a couple of hours and listen to some "classical" or acoustical instrument music. Vary it between small ensemble and orchestral music. Stay away from electronic/rock qualities for a few hours.
2. Keep your ears away from high volume levels, even in the car for a few hours. Let your ears truly rest and become more sensitive.
3. Add some high quality, analog treatment devices to your instrument, such as:

REVERB  
DIGITAL DELAY LINES  
CHORUS DEVICES

.....but remember: a poor quality device will not add to the high fidelity of the system.

DON'T get forced into a position of "making a choice" between digital synthesis and analog. They are both wonderful, and both unique.

DO draw upon those things you may have learned about sound in your analog synthesis experiences. Just be aware that some of the concepts do not make sense to mix, especially the operation of the hardware.

We at DIGITAL KEYBOARDS truly believe you have the most powerful digital synthesizer at any price. We welcome your questions and opinions.

Good luck, and stay in touch.

Tom Piggott

If you are a college professor, a computer enthusiast, or working with numbers as a sound producing tool, the logic of producing sound on this system will come quickly. If you are an " analog " musician, aspiring to make basic musical tones with this system, you'll need some starting hints, and some stepping stones from your former experiences. Here's a small attempt at getting you started:

LET'S BE CERTAIN THAT:

1. You are working with a full blown SYNERGY II PLUS, as described in the front of this manual. It is, therefore, A General Development System ( GDS).
2. Your SYNERGY has the following:
  - 3X software chips and PC board addition
  - RS232 and Program jack plate in rear
  - RS232 Cable
  - Software disks
  - Computer ( preferable KAYPRO II or equivalent.
  - MIDI ( In, Out, Through )
3. You are familiar with the operation of the Synergy without the computer attached.

NOTE: If you have purchased your Synergy as a complete system, it is important that you go through the owner's manual for operational knowledge about the instrument without computer functions.

4. You have a Synergy owner's manual, and the addendum that familiarizes you with the operation of the new 3X features such as:
  - SEQ out jack
  - REC out jack
  - MIDI and related capabilities
  - New features for front panel

If any of the above comments are not understood, please call us at once ( 800-645-6094.) Leave your name and number with Ms. Rizzi or D. Briefel, so a technician can get back to you.

If all the above are understood and " in place," you are ready to start the extended learning procedures.



## VOICING ( PROGRAMMING ) THE GDS/SYNERGY SYSTEM

The word VOICING is used more than the word programming in this manual. You do not need to " PROGRAM " the computer to make your own sounds. It is already programmed to allow you to synthesize your own sounds with " menu driven " software. Having connected the computer to the RS232 connector of the SYNERGY, you are ready to begin.

NOTE: If you have a computer other than a Z80 based system operating on CPM 2.2 software, the software will NOT WORK. You must have:

A Z80 option if not already in your computer  
CPM 2.2 Operating system  
At least 64 k of computer power

and should have:  
2 disk drives.

When you have these items, BUT DO NOT HAVE A KAYPRO II system, you will have to do some minor software procedures before you begin. If you do not understand these procedures, which are clearly spelled out in the technical documentation, call us for advice and procedural information.

The suggested and most practical computer for our programs is the KAYPRO II, which we can attain for you at a very reasonable price. Often this price will be lower than the money you will have to spend to make your computer compatible with our software!

If you have a KAYPRO II, Let's get started:

With all proper connections made, insert the SYSTEM disk into drive A.

Insert the " LEARNING " disk into drive B.

Go through the operation of controls and programs, starting on page 1.